Space Weather Forecast

Issued on Saturday, 16 July 2022 at 13:05 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Moderate X-ray flares likely throughout. Chance of Minor Geomagnetic Storms at very end of period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity increased to moderate once again over the past 24 hour period, with X-ray flares peaking with a moderate class flare from a sunspot in the northeast of the Sun at 16/0629UTC. This sunspot was one of up to seven on the facing side at present, with almost all of this roster comprising large and mature sunspots.

Main trends in the front side groups were for overall growth in most of the regions, however the two large spot groups nearing the western solar horizon showed a more stable or slightly declining areal trend, while a newly-numbered calved off portion of a spot group in the far east was an unremarkable magnetically unipolar spot.

One of the large 'filaments' (arcs of plasma) that have occupied the Sun in recent days did finally lift off in the period - a significant northwest-based feature that bifurcated and largely erupted heading north and west of the Sun-Earth line between 13/1300 and 1600UTC. The resulting Coronal Mass Ejection (CME) was clearly visible in resulting satellite imagery, with good triangulation available from a satellite upwind of Earth. Numerous assessments of this ejecta have been carried out as further imagery has become available, and have crystallised into a most likely arrival time around the turn of the UTC day Tuesday 19 July into Wednesday 20 July. Further to the above event, the de-stabilised northeastern remnant of the above filament eruption was then also seen to erupt around 16/0300-0500UTC. Resulting imagery is not yet available for this later event, however an Earth-bound component is again very possible to any CME and analysis will be conducted when imagery allows.

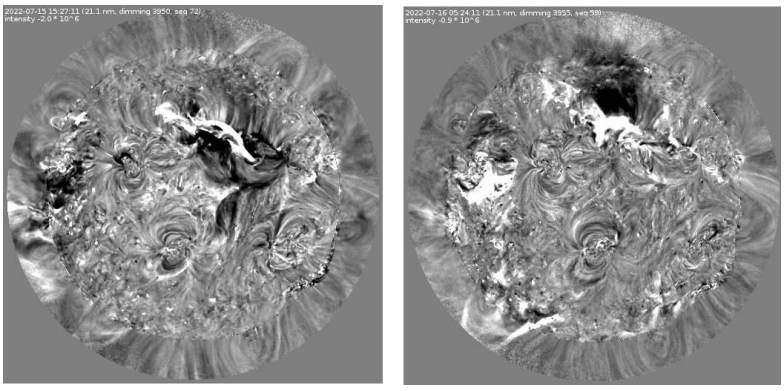

Figure 1: SIDC ROB time-integrated extreme UV imagery of up to two large 'filament eruptions' in the northwest of the sun (centre upper right, both images). The leftmost (15/1300UTC) has a confirmed Earth-directed component, due Tuesday 19 into Wednesday 20 July; the rightmost (16/0300UTC) is as yet unconfirmed.

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In addition to the filaments, an active sunspot group in the eastern solar hemisphere continued its recent habit of minor X-ray flaring and narrow-angled eastward-directed (i.e. behind Earth in the track of its orbit) CMEs. These have been modelled and are considered unlikely to have an Earth-bound component, although should this behaviour persist then this will become increasingly relevant into the new week as the spot responsible points more directly at Earth.

One CME is therefore thought likely to be en route, that from the 15/1300UTC filament, with a second event from a similar location 16/0300UTC awaiting imagery. The former is due around 19/2359UTC; the latter to be confirmed.

Solar Wind / Geomagnetic Activity: The solar wind has been elevated over the past 24 hours, likely the result of a now slightly waning 'coronal hole' high speed stream.

The solar wind speed was elevated throughout, with a relatively stable trend perhaps easing for more lasting periods later in the UTC morning. The number of particles comprising the wind was slightly elevated, but again with a slight easing trend as the period matured. The magnetic field associated with the particles was within background levels, but with a persistent anti-aligned character (versus the Earth's field).

The net result of the above solar wind measures was nevertheless provisionally quiet, well below Minor Storm G1 throughout.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is Likely to be moderate, with a daily slight chance of strong-class flares. Two of the current large sunspots should leave the Earth-facing side of the Sun into the new week, resulting in a slight reduction in flare probability. Arriving bright flux over the eastern solar horizon may signify arriving sunspots which could compensate for any loss, however, with this to be confirmed.

Solar Wind / Geomagnetic Activity: The 15/1300UTC 'filament' CME is due at the very end of the current forecast period, around the turn of the UTC day Tuesday 19 into Wednesday 20 July. A second CME from a similar location produced 16/0300UTC is undergoing assessment. No other CMEs feature.

Two fast wind streams may feature in the forecast: firstly an exit from the long-peaked current high speed stream; and secondly minor influence from a smaller, less intense feature on day four (Tuesday 19 July).

All considered, activity should soon decline to quiet, but increase to a (probably protracted) chance of Minor Storm G1 on Tuesday 19 July from the combined effect of the 15 July CME mentioned above, and any concurrent high speed stream. The slow speed of the assessed CME and the prospect of a second one along a similar track (TBC) may result in the risk of G1 extending through midweek UTC before easing.

Energetic Particles / Solar Radiation: There remains a daily slight chance of S1 or greater solar radiation storms due to the presence of large sunspot regions in the better-connecting (with Earth) central and western portions of the Sun.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	60	60	50	40
Very Active	R3 to R5 X	No	10	10	5	5

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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